

COURSE OF STUDY

Idaho Department of Education



Pre-Algebra

Enhanced with the Idaho Student Information Technology Standards

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IDAHO DEPARTMENT OF EDUCATION

Mathematics

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Table of Contents

Introduction.....	i
A Note About Using This Document.....	ii
Student Evaluation Philosophy	iii
BLOCK 1: Algebra And Functions	4
BLOCK 2: Arithmetic, Computation, And Estimation	8
BLOCK 3: Data Analysis, Probability, And Statistics	11
BLOCK 4: Measurement And Geometry.....	15
BLOCK 5: Problem Solving And Mathematical Reasoning	20
♦ Guidelines/Strategies and Tips.....	22
APPENDIX A: Resources	23
APPENDIX B: Sample Lesson Plan	27
APPENDIX C: Idaho Student Information Technology Standards	39

Introduction

“The Universe is a grand book which cannot be read until one first learns to comprehend the language and become familiar with the characters in which it is composed. It is written in the language of mathematics.”

Galileo Galilei

This Middle School Course of Study document is designed to be user friendly. Units can be used sequentially and each unit may need a different amount of time to complete. When using this document, consider the students’ prior knowledge and their understanding of the concepts.

The Idaho Mathematics Achievement Standards are consistently referenced as they form the basis of this organizational document. They have been combined in the units so that students and teachers can readily see connections between mathematical concepts. Additionally, connecting mathematical concepts to other curricular areas is a powerful tool. Suggested activities are listed with possible, and yet, not all-inclusive, cross-curricular connections. Connections with the Idaho Student Information Technology Standards are also encouraged and specific grade-level Technology Standard Benchmarks are provided in Appendix C. Along with connections between mathematical concepts, cross-curricular areas, and technology standards, ***mathematical process skills involving mathematical communication, reasoning, and problem solving should be addressed and used throughout all the units, all year.***

Identified “Power Standards” are denoted in red font and consist of a subset of the Mathematics Achievement Standards specific to grade-level Content Knowledge and Skills. Committees worked to determine these Power Standards as they met the original intent of the Mathematics Achievement Standards now in Idaho Code and as they met the criteria of 1) endurance, 2) flexibility, and 3) foundation for the next level(s) of learning. These committees also kept in mind the possible ways in which the identified Power Standards might be used. Possible future, and as yet undetermined, uses might involve the Idaho Student Information System (ISIMS), the Idaho Standards Achievement Test (ISAT), the Direct Mathematics Assessment (DMA), and, perhaps most importantly, helping first-year teachers. Note that some Power Standards may not be assessed at certain grade level such as those involving exploration and/or discovery.

As no one textbook is perfectly aligned to the state standards or able to reach every student, supplementing will be necessary. Therefore, suggested resources and lesson plans are included in Appendices A and B, respectively. The resource *Adding It Up* (National Research Council, 2001) is very helpful and identifies five strands of mathematical proficiency: conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition.

A special thank you to the committee members for their diligent and conscientious work on this document and especially to Cathy Moore, Cascade Junior-Senior High School, for facilitating the meetings.

Susan Harrington

Using This Document

This Mathematics Course of Study provides a starting point for teachers whose districts have not formalized their own standards-based curriculum as well as additional support for those whose districts have developed and published standards-based curriculum. Although the suggestions that follow form a framework that addresses all relevant Idaho standards, we are hopeful that teachers will incorporate their own professional training and experience to complete the course. The suggested activities representative alternative activities that may assist students achieve objectives. We encourage teachers to seek those activities that most capitalize on local resources or interests. Employed strategies may implement or extend opportunities for students to meets standards. We encourage teachers to identify additional activities and the standards they address for possible inclusion in a future revision and expansion of this guide.

Student Evaluation Philosophy

Assessment of student progress toward mastering individual standards should be on-going and imbedded within instructional blocks. Ideally, assessments should be formative in nature and assist to guide subsequent instruction. We encourage a variety of approaches to assessing student performance: performance, portfolios, and traditional testing. At the completion of this course, an end of course summary assessment device can validate student achievement.

Algebra and Functions

The student will demonstrate understanding of patterns, relationships, functions, and the use of variables.

Objectives

Reference to Idaho Standards

- | | |
|---|--|
| 1. Develop fluency with the use of variables and algebra symbols in written and algebraic statements. | 340.01.a, 340.01.b,
340.01.c |
| 2. Apply properties and order of operations in simplifying algebraic expressions. | 340.02.a, 340.02.b,
340.02.c |
| 3. Solve 1-step and 2-step equations. | 340.03.a |
| 4. Explore, use, and extend patterns, relations and functions. | 343.01.a, 343.01.b,
343.01.c, 343.02.a,
340.03.b, 343.03.a |

Standard: 340.01**Use algebraic symbolism as a tool to represent mathematical relationships.****Content Knowledge and Skills:**

- 340.01.a Understand and use variables in expressions, equations, and inequalities.
- 340.01.b Translate simple word statements and story problems into algebraic expressions and equations.
- 340.01.c Use symbols ($<$, $>$, $=$, \leq , \geq , \neq) to express relationships.

Standard: 340.02**Evaluate algebraic expressions.****Content Knowledge and Skills:**

- 340.02.a Understand and use the following properties in evaluating algebraic expressions: commutative, associative, identity, zero, inverse, distributive, and substitution.
- 340.02.b Understand and use the order of operations in evaluating basic algebraic expressions.
- 340.02.c Simplify algebraic expressions.

Standard: 340.03**Solve algebraic equations and inequalities.****Content Knowledge and Skills:**

- 340.03.a Solve one- and two- step equations and inequalities using inverse operations.
- 340.03.b Explore graphical representation to show simple linear equations.

Standard: 343.01**Understand the concept of functions.****Content Knowledge and Skills:**

- 343.01.a Extend patterns and identify a rule (function) that generates the pattern using real numbers.
- 343.01.b Use functional relationships to explain how a change in one quantity results in a change in another.
- 343.01.c Understand and use appropriate vocabulary.

Standard: 343.02

Represent equations, inequalities, and functions in a variety of formats.

Content Knowledge and Skills:

343.02.a Represent a set of data in a table, as a graph, and as a mathematical relationship.

Standard: 343.03

Apply functions to a variety of problems.

Content Knowledge and Skills:

343.03.a Use patterns and functions to represent and solve problems.

Suggested Activities	Content Standards	Technology Standards	Curricular Connections
1. Use Algebra Tiles to explore algebraic expressions.	340.01		
2. Use programs such as “Hands on Linear Algebra” to solve equations.	340.01		
3. Competitions such as quiz bowl and math relays for solving equations.	340.01	1.1, 1.2, 3.1	
4. Use individual white boards to practice algebra skills.	340.01, 340.02, 340.03	1.1, 1.2, 3.1	
5. Function machines where you input a number, output a number, guess the rule, and graph.	343.01	1.1, 1.2, 3.1, 6.1	Science
6. Use colors to show the order of operations.	340.02		
7. Have students design mnemonics for remembering the order of operations.	340.02		
8. Given a line, locate points on the line.	340.03		
9. Use flash cards to practice inequalities, properties, etc.	340.01, 340.02		
10. Act out the properties in mini skits. For example, students act as different variables in front of the class and interact in the same manner as the property.	340.02		
11. Create a 5 th side to a monopoly type board.	343.03		
12. Human Coordinate Plane and number line activities where students manipulate themselves on a coordinate plane or number line on the floor.	340.01, 343.02		

Arithmetic, Computation, and Estimation

The student will demonstrate understanding of numbers and how they are used.

Objectives

1. Understand and use real numbers.
2. Use estimation to predict and verify results.
3. Evaluate rational number expressions.

Reference to Idaho Standards

337.01.a, 337.01.b,
337.01.c, 337.01.e,
337.02.b, 337.02.d,
337.02.f, 337.03.d

337.03.a, 337.03.b,
337.03.c

337.01.d, 337.02.a,
337.02.c, 337.02.e

Standard: 337.01

Understand and use numbers.

Content Knowledge and Skills:

- 337.01.a Read, write, order, and compare real numbers (integers, fractions, decimals, percents, ratios) and absolute values.
- 337.01.b Understand and use real numbers, both rational and irrational.
- 337.01.c Show a sense of magnitudes and relative magnitudes of real numbers (integers, fractions, decimals) using scientific notation and exponential numbers.
- 337.01.d Develop and apply number theory concepts.
- 337.01.e Understand the position of real numbers on a number line.

Standard: 337.02

Perform computations accurately.

Content Knowledge and Skills:

- 337.02.a Consistently and accurately add, subtract, multiply, and divide rational numbers.
- 337.02.b Instantly recall common equivalent fractions, decimals, and percents.
- 337.02.c Evaluate numerical expressions using the order of operations.
- 337.02.d Understand and use exponents.
- 337.02.e Select and use an appropriate method of computation from mental math, paper and pencil, calculator, or a combination of the three.
- 337.02.f Use appropriate vocabulary.

Standard: 337.03

Estimate and judge reasonableness of results.

Content Knowledge and Skills:

- 337.03.a Use estimation to predict computation results.
- 337.03.b Recognize when estimation is appropriate and understand the usefulness of an estimate as distinct from an exact answer.
- 337.03.c Determine whether a given estimate is an overestimate or underestimate.
- 337.03.d Use appropriate vocabulary.

	Suggested Activities	Content Standards	Technology Standards	Curricular Connections
1.	Buying, selling and tracking stocks	337.01, 337.02	1.1, 1.2, 5.1, 5.2	Social Studies
2.	Writing checks.	337.01		
3.	“Powers of Ten” video on scientific notation	337.01, 337.02		
4.	Investigate properties of other number systems using different bases.	337.02	1.1, 1.2, 3.1, 6.1	
5.	“Price is Right” type activities.	337.03		
6.	Given a budget of \$10 and a list of available products with prices, estimate what you could buy.	337.03		
7.	Estimate sums, products, quotients, then use a calculator to check.	337.03	1.1, 1.2, 3.1,	
8.	Estimate measures of center based on visual display of data.	337.03	1.1, 1.2, 3.1, 5.1, 5.2	
9.	Use individual whiteboards, relays, or competitions to enhance student understanding.	337.02	1.1, 1.2, 3.1	
10.	Plan a shopping trip or plan a vacation.	337.02	All	Language Arts Social Studies

Data Analysis, Probability, and Statistics

The student will demonstrate understanding of the concepts and processes used in analyzing data and making predictions.

Objectives

1. Understand and use the language of probability.
2. Conduct experiments, interpret results, and make predictions.
3. Choose and calculate measures of center and spread of a set of data.
4. Collect, display, and analyze data.

Reference to Idaho Standards

342.01.c, 342.04.b,
342.04.c

342.04.a, 342.05.a,
342.05.b, 342.05.c

342.03.a, 342.03.b

342.01.a, 342.01.b,
342.02.a

Standard: 342.01**Understand data analysis.****Content Knowledge and Skills:**

- 342.01.a Analyze and interpret tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).
- 342.01.b Explain and justify conclusions drawn from tables, charts, and graphs.
- 342.01.c Understand and use appropriate vocabulary.

Standard: 342.02**Collect, organize, and display data.****Content Knowledge and Skills:**

- 342.02.a Collect, organize, and display data with appropriate notation in tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).

Standard: 342.03**Apply simple statistical measurements****Content Knowledge and Skills:**

- 342.03.a Choose and calculate the appropriate measure of central tendency – mean, median, and mode.
- 342.03.b Explore the significance of range, frequency, and informal distribution.

Standard: 342.04**Understand basic concepts of probability.****Content Knowledge and Skills:**

- 342.04.a Model situations of probability using simulations.
- 342.04.b Understand and use the language of probability.
- 342.04.c Recognize equally likely outcomes.

Standard: 342.05

Make predictions or decisions based on data.

Content Knowledge and Skills:

342.05.a Make predictions based on experimental and theoretical probabilities.

342.05.b Understand and use appropriate vocabulary.

342.05.c Conduct statistical experiments and interpret results using tables, charts, or graphs.

Suggested Activities	Content Standards	Technology Standards	Curricular Connections
1. Cut graphs, tables and charts out of newspapers/magazines and discuss attributes.	342.01		Social Studies
2. Scatter plot party where you measure various quantities such as length of stride, width of eye, etc. and graph results. Then decide where there are relationships.	342.02	1.1, 1.2, 3.1	Health Science
3. M&Ms project creating various types of graphs.	342.02, 342.03	1.1, 1.2, 3.1, 6.1	
4. Discuss when to use median vs. mean.	342.03		
5. Frog Olympics where students create origami frogs, jump them, measure results, calculate measures of center, then compete against each other.	342.02, 342.04, 342.05	1.1, 1.2, 3.1, 5.2	Art Language Arts Science Social Studies
6. Activity deciding how likely a given situation is to happen.	342.04		
7. Drawing marbles out of a hat. Explain difference between experimental and theoretical probability.	342.05		
8. How many females are expected in a family with 3 children simulation.	342.04, 342.05	1.1, 1.2, 3.1	
9. Design a pie chart by arranging M&Ms in color sequence around the edge of a circle. Figure degree and percent.	342.02		
10. Coin toss, dice, and playing card activities.	342.04	1.1, 1.2, 3.1	
11. Survey kids in your school and present results.	342.02, 342.05	1.1, 1.2, 3.1, 4.1, 5.1, 5.2	Language Arts Social Studies
12. Create stem-and-leaf and box-and-whisker plots.	342.02	1.1, 1.2, 3.1, 5.2	

Measurement and Geometry

The student will demonstrate understanding of spatial relationships and measurement.

Objectives

Reference to Idaho Standards

- | | |
|---|---|
| 1. Understand and use ratios, proportions and scales. | 339.03.a, 339.02.a |
| 2. Investigate the Pythagorean Theorem. | 341.02.a |
| 3. Measure and convert using U.S. Customary and metric systems. | 339.01.a, 339.01.b,
339.01.e, 339.01.f,
339.04.a |
| 4. Use the coordinate plane. | 341.03.a |
| 5. Solve problems and understand the relationships and fundamental concepts among 1, 2, and 3 dimensional objects and their measurements. | 339.01.c, 339.01.d,
341.01.a, 341.01.c,
341.01.e, 341.01.f,
341.01.h |
| 6. Recognize and apply congruency, similarity, symmetry and transformation. | 341.01.d, 341.01.g |
| 7. Construct and measure angles and shapes. | 341.01.b |

Standard: 339.01**Understand and use U.S. customary and metric measurements****Content Knowledge and Skills:**

- 339.01.a Select and use appropriate units and tools to make formal measurements using both systems.
- 339.01b Apply estimation of measurement to real-world and content problems using actual measuring devices.
- 339.01.c Recognize the differences and relationships among measures of perimeter, area, and volume (capacity) in both systems.
- 339.01.d Solve problems involving length, perimeter, area, volume (capacity), weight, mass, and temperature.
- 339.01.e Convert unit of measurement within each system.
- 339.01.f Use appropriate vocabulary.

Standard: 339.02**Apply concepts of rates and other derived or indirect measurements.****Content Knowledge and Skills:**

- 339.02.a Use rates to make indirect measurements.

Standard: 339.03**Apply the concepts of ratios and proportions.****Content Knowledge and Skills:**

- 339.03.a Understand and use proportions, ratios, and scales.

Standard: 339.04**Apply dimensional analysis.****Content Knowledge and Skills:**

- 339.04.a Understand units and their relationship to one another and to real-world applications.

Standard: 341.01**Apply concepts of size, shape, and spatial relationships.****Content Knowledge and Skills:**

- 341.01.a Precisely describe, classify, and understand, relationships among types of one-, two-, and three-dimensional objects using their defining properties.
- 341.01.b Construct and measure various angles and shapes using appropriate tools.
- 341.01.c Understand and apply fundamental concepts, properties, and relationships among points, lines, planes, angles, and shapes.
- 341.01.d Recognize and apply congruence, similarities, and symmetry of shapes.
- 341.01.e Apply formulas for perimeter, circumference, and area to polygons and circles.
- 341.01.f Understand the concept of surface area and volume (capacity).
- 341.01.g Explore and model the effects of reflections, translations, and rotations on various shapes.
- 341.01.h Use appropriate vocabulary.

Standard: 341.02**Apply the geometry of right triangles.****Content Knowledge and Skills:**

- 341.02.a Investigate right triangle geometry using the Pythagorean Theorem.

Standard: 341.03**Apply graphing in two dimensions.****Content Knowledge and Skills:**

- 341.03.a Use the coordinate plane as it relates to real-world applications.

Suggested Activities	Content Standards	Technology Standards	Curricular Connections
1. Create tessellations using various media.	341.01	1.1, 1.2, 3.1, 6.1	Art
2. Using Snap/Unifix Cubes to create figures to find volumes and surface areas.	339.01, 341.01		
3. Discover volume of pyramids as they relate to prisms by using water.	339.01, 341.01		
4. Create prisms, pyramids and models using paper, cardboard, toothpicks, pipe cleaners, etc.	339.04, 341.01		Art
5. Use graph paper to transform shapes.	341.01		
6. Find the volume of the room using U.S. Customary measure then convert to metric measure.	339.01	1.1, 1.2, 3.1	Science
7. Measure angles, distances, and volumes.	339.01, 341.01	1.1, 1.2, 3.1	Science
8. Make posters of parallel, perpendicular, angles, etc. from things in nature.	341.01		Art Science
9. Understand coordinate plane using maps.	341.03		Social Studies
10. Where's Waldo on a coordinate plane activities where you find Waldo then give his location on a coordinate plane.	341.03		Social Studies
11. Use Alpha Shapes to discover area/circumference formulas.	339.01, 339.03, 341.01		
12. Create models of stained glass windows. Show dimensions, angle measures and calculate area of each piece.	339.03, 339.04, 341.01	1.1, 1.2, 3.1, 5.2, 6.1	Art
13. Locate reflections, rotations and translations from real world objects.	339.04, 341.01		Art Music
14. Cartoon scale drawings.	339.03		Art

15.	Quilting activities.	339.01, 341.01, 341.02	1.1, 1.2, 3.1, 6.1	Art
16.	Design a room and construct a diorama of your room.	339.03, 339.04	1.1, 1.2, 3.1, 6.1	Art
17.	Use clinometers to determine height of tall objects.	339.01, 339.02	1.1, 1.2, 3.1, 6.1	Science
18.	Geometric Treats (candies) posters- create or investigate.	341.01		
19.	Use compass, protractor and Miras to construct and transform.	341.01		Art
20.	Scavenger hunt for an item of given size.	339.01	1.1, 1.2, 2.1, 3.1, 5.1	
21.	Use indirect measurement to calculate altitude of rocket's path. Could also use arrows.	339.02	1.1, 1.2, 3.1, 5.2, 6.1	Science
22.	Creating mixtures such as insecticides, recipes and hair color by using ratios and proportions.	339.03	1.1, 1.2, 3.1, 6.1	Science
23.	Design packaging for a new product.	341.01	1.1, 1.2, 3.1, 6.1	Art
24.	Experiment to find relative strengths of different triangles.	341.01, 341.02	1.1, 1.2, 3.1, 5.1, 5.2, 6.1	Science
25.	Use Pythagorean Theorem to discover which way the wall is leaning.	341.02	1.1, 1.2, 3.1, 6.1	Science
26.	Find lengths of guy wires for cell phone towers.	341.02	1.1, 1.2, 3.1, 6.1	Science
27.	Relating GPS systems to coordinate plane using runways.	341.03	1.1, 1.2, 2.2, 5.1	Science Social Studies
28.	Create kites using garbage sacks, straws and strings.	341.01, 341.02		Art
29.	Using graph paper, find areas/perimeters.	341.01, 341.03		

Problem Solving and Mathematical Reasoning

The student will demonstrate understanding of problem solving strategies and incorporate them where appropriate.

Objectives

Reference to Idaho Standards

- | | |
|--|---------------------------------|
| 1. Understand and use a variety of problem-solving skills. | 338.01.a, 338.01.b,
338.01.c |
| 2. Use reasoning skills to recognize problems and express them mathematically. | 338.02.a, 338.02.b,
338.02.c |
| 3. Apply appropriate technology and models to find solutions to problems. | 338.03.a, 338.03.b,
338.03.c |
| 4. Communicate results using appropriate terminology and methods. | 338.04.a, 338.04.b,
338.04.c |

Standard: 338.01**Understand and use a variety of problem-solving skills.****Content Knowledge and Skills:**

- 338.01.a Use a variety of strategies, including common mathematical formulas to compute problems drawn from real-world situations.
- 338.01.b Recognize pertinent information for problem solving.
- 338.01.c Make predictions and decisions based on information.

Standard: 338.02**Use reasoning skills to recognize problems and express them mathematically.****Content Knowledge and Skills:**

- 338.02.a Use a variety of methods, such as words, numbers, symbols charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.
- 338.02.b Apply solutions and strategies to new problem situations.
- 338.02.c Formulate conjectures and justify (short of formal proof) why they must be or seem to be true.

Standard: 338.03**Apply appropriate technology and models to find solutions to problems.****Content Knowledge and Skills:**

- 338.03.a Understand the purpose and capabilities of appropriate technology use as a tool to solve problems.
- 338.03.b Use computer applications to display and manipulate data.
- 338.03.c Select appropriate models to represent mathematical ideas.

Standard: 338.04**Communicate results using appropriate terminology and methods.****Content Knowledge and Skills:**

- 338.04.a Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to communicate mathematical information.
- 338.04.b Use appropriate vocabulary to communicate mathematical information.

338.04.c Use appropriate notation.

Problem Solving and Reasoning Guidelines

1. Read and understand the problem.
2. Make a plan to solve the problem.
3. Solve the problem.
4. Check the reasonableness of your answer.

Suggested Strategies and Tips

1. Draw a diagram.
2. Guess and test.
3. Use logical reasoning.
4. Look for a pattern.
5. Make a table.
6. Simulate a problem.
7. Solve a simpler problem.
8. Too much or too little information?
9. Use multiple strategies.
10. Work backwards.
11. Write an equation.
12. Keep trying.
13. Take chances.
14. Use what you know.
15. Practice.
16. Watch what you do.
17. Take a break.

APPENDIX A

Resources

Resources

Books

<u>Title</u>	<u>Publisher or Author</u>
<i>Adding it Up</i>	National Research Council
<i>Algebra Survival Guide</i>	Singing Turtle Press
<i>Dr. Math Gets You Ready for Algebra</i>	Math Forum John Wiley & Sons, Inc
<i>Algebra</i>	John Wiley & Sons, Inc
<i>Family Math</i>	Jean Kerr Stanmark, et al.
<i>Family Math for the Middle Years</i>	Karen Mayfield-Ingram. et al.
<i>Math On Call</i>	Great Source Education Group Houghton Mifflin Co.
<i>Math For All Seasons</i>	Greg Tang
<i>Math, Literature and Manipulatives</i>	Don Balka and Richard Callan
<i>Math Through Children's Literature</i>	Kathryn Braddon, Nancy Hall and Dale Taylor
<i>Schaum's Outlines</i> --Elementary Algebra --Geometry --Probability & Statistics --Trigonometry --Calculus	McGraw-Hill
<i>United States Atlas for Young Explorers</i>	National Geographic Society

Websites

<http://www.mathispower.org>

<http://www.mathpower.com>

<http://www.forum.swarthmore.edu/dr.math/>

<http://www.visualfractions.com/>

<http://www.scienceacademy.com/BI/>

Please note: the “Results” scoring appears to have a problem. However, the problems themselves are worthwhile.

<http://www.funbrain.com/numbers.html>

ENC Focus (vol. 7, no. 3)

www.enc.org/focus/realworld

www.economist.com/editorial/freeforall/focus/big_mac_index.html

Salary Calculator

www.homefair.com/homefair/cmr/salcalc.html

Currency Exchange Rate

www.oanda.com/converter/classic

www.x-rates.com/tables/USD.html

Center for Understanding the Built Environment

www.cubekc.org

Additional

Algebra to Go: Houghton Mifflin (<http://www.greatsource.com>)

Data-Driven Mathematics Series: Pearson Learning

Dynamic Geometry software such as:

Geometer's Sketchpad (Exploring Geometry and Shape Makers)

Cabri Geometry

Peanut Software

FATHOM statistics software: Key Curriculum Press

Geometry to Go: Houghton Mifflin (<http://www.greatsource.com>)

Green Globes software: Sunburst

Idaho MathCounts (<http://home.rmci.net/ispe/MathCounts.htm>)

Quantitative Literacy Series: Pearson Learning

Marco Polo web site (<http://www.worldcom.marcopolo.com>)

Math Forum web site (<http://www.mathforum.org>)

MESA Earthquake: Addison Wesley

National Council of Teacher of Mathematics (NCTM) Principles and Standards 2000
and NCTM Addenda Series (<http://www.nctm.org>)

NCTM Illuminations web site (<http://illuminations.nctm.org/pages/912.html#lp>)

NCTM Navigations Series (<http://www.nctm.org/standards/navigations.htm>)

PBS Math web site (<http://www.pbs.org/teachersource/math.htm>)

Project MATHEMATICS! web site (<http://www.projmath.caltech.edu/>)

APPENDIX B

Lesson Plans

5th Side to the Monopoly Board

Grade Level: 7th & 8th

Focus: Algebra and Functions

Concept: Extending patterns

Objectives: Students will be able to do the following

- Determine the cost of the new properties and their rents by extending the patterns from the cost of the existing properties.
- Create names and color codes for the new properties.
- Add at least 5 properties, 1 utility, 1 railroad, and 2 squares of students' choice.

Idaho Achievement Standards:

343.01 - Understand the concept of functions

343.03 - Apply functions to a variety of problems.

Content Knowledge and Skills:

343.01a - Extend patterns and identify a rule (function) that generates the pattern using real numbers.

343.03a - Use patterns and functions to represent and solve problems.

Procedure for Teaching:

Discuss the monopoly board and the existing patterns (since Park Place and Boardwalk don't fit the pattern, they can remain where they are or they can be moved to the end and then adjust the prices to fit the pattern.

Explain the requirements for their new properties (i.e., 1 utility, 1 railroad, at least 5 new properties, and 2 squares of their choice)

Minimum requirement is to create the 5th side of the board. Students may draw the entire board, including the 5th side. You could offer extra credit for this option.

Materials and Resources:

1 monopoly game per every 3-4 students, poster board, rulers, colored markers and protractors.

Midget Chalk Row Race

Grade Level: 7th & 8th

Focus: Arithmetic, Computation and Estimation

Concept: Game Style Review

Objectives

Students will be able to do the following:

- Increase a students speed and a accurately in computation.

Idaho Achievement Standards:

327.01 - Understand and use numbers

327.02 - Perform Computations accurately

327.03 - Estimate and judge reasonableness

Content Knowledge and Skills: all within these standards

Procedure for Teaching: Divide into rows or groups. Each group is given small piece of chalk or writing instrument. Each student in their group is given a contestant number (i.e. contestant 1 through 6). A problem is given, all students are given a short time to complete the problem. Group discussion is encouraged. A contestant number is chosen at random. Each contestant with the selected number races to the board and works out the problem for their group. Points are given to group (i.e. 10 pts. for 1st, 8 pts. for 2nd, 6 pts. for the remaining groups that have the correct solution to the problem). Team with most points wins.

Materials and Resources:

Paper, pencil, book, chalk or dry eraser marker - depending on the board (save your small chalk pieces).

Method to select contestant (possibly playing cards)

Select problems ahead of time.

Are Your Walls Leaning?

Grade Level: 8th

Focus: Measurement and Geometry

Concept: Apply the Pythagorean Theorem

Objectives

Students will be able to do the following:

- Measure with centimeters.
- Use Pythagorean theorem to test accuracy of construction.
- Determine from collected data the direction of the leaning wall.

Idaho Achievement Standards:

341.02 - Apply the Geometry of right triangles.

Content Knowledge and Skills:

341.02a - Investigate right triangle geometry using the Pythagorean Theorem.

Procedure for Teaching: Students are divided into groups. Each group is given a meter stick and some tape. The groups are assigned to check walls in the school, to see if they are leaning. Their job is to figure out which way their wall will fall in an event of an earthquake. Students should measure some distance up the wall and work their location with a small piece of tape (side a). They then measure a distance away from the wall on the floor and mark it with a piece of tape (side b). Using a longer piece of tape they should connect their floor and wall points. This longer piece of tape acts as the hypotenuse's to their triangle (side c). Students should then figure $a^2 + b^2$ and see if it equals c^2 . Then measure the hypotenuses and figure if it is too long or too short. The group then reports to the class their findings.

Materials and Resources:

Meter sticks for each group

Pieces of masking tape for each group

Calculate for each group would prove useful.

Patty Paper Tessellations

Grade Level: 7th & 8th

Focus: Measurement and Geometry

Concept: Explore transformation

Objectives

Students will be able to do the following:

- Create a shape to tessellate by transferring
- The shape from patty paper onto a 3 X 5 card
- Translate the shape onto 11½ X 8½ in paper

Idaho Achievement Standards:

331.01 - Apply concepts of size, shape, and spatial relationships.

Content Knowledge and Skills:

331.01a - Precisely describe, classify, and understand, relationships among types of one-, two-, and three-dimensional objects using their defining properties.

Procedure for Teaching: Trace the 4 points from the dot paper onto the patty paper. Draw a simple design connecting the top two points and the bottom two points on the dot paper. Line up points on patty paper and trace the two connecting designs. Slide patty paper to the left until points are lined up. Trace the design. Line up four points, slide patty paper up matching points on top. Trace the design. Put top side of patty paper down on the 3 X 5 card. Trace over the 4 sided shape (pencil lead will transfer to the 3 X 5 card). Remove patty paper and cut out the shape. Translate the shape on the 11½ X 8½ paper. Fill in details to turn shape into something (animal, flower, clown, etc.). Color and outline the final shape.

Materials and Resources:

Patty paper (paper that is put between hamburgers), 3 X 5 cards, scissors, fine black markers, #2 pencil, 11½ X 8½ paper, 2 transparencies (1 plain & 1 1in. dots), 1 in. dot paper, colored pencils,

Statistics Bubble Activity

Grade Level: 7-8th

Focus: Use real data to compare.

Concept: Blowing bubbles to generate data on the size of a bubble and using measures of center to compare those sizes.

Objectives

Students will be able to do the following:

- Discuss data collection techniques
- Collect data using measurement of the diameter of a bubble.
- Compare results using measures of central tendency and distribution (range).
- _____
- _____
- _____

Idaho Achievement Standards: 342.02 and 342.03: Apply simple statistical measurements and collect, organize, display data.

Content Knowledge and Skills: 342.02a and 342.03a: Understand and use the measures of central tendency- mean, median and mode with simple sets of data. Collect, organize and display the data with appropriate notation in tables, charts and graphs.

Materials and Resources:

Bubble solution with wands to create bubbles, surface on which to blow bubbles (some people use black garbage sacks but I just use any flat surface), string to measure, rulers.

Create a Model for a Stain Glass Window

Grade Level: 7th & 8th

Focus: Measurement and Geometry

Concept: Area of geometric shapes

Objectives

Students will be able to do the following:

- Measure shapes with a consistent measure (inches, centimeter, etc.)
- Use area formulas to calculate the area of various shapes
- Calculate the combine area of the window

Idaho Achievement Standards:

339.03 Apply the concepts of ratios and proportions

339.04 Apply dimensional analysis

341.01 Apply concepts of size, shape, and spatial relationships

Content Knowledge and Skills:

339.03a Understand and use proportions, ratios, and scales

339.04a Understand units and their relationship to one another and to real-world applications.

341.01b Construct and measure various angles and shapes using appropriate tools.

341.01e Apply formulas for perimeter, circumference, and area to polygons and circles.

341.01h Use appropriate vocabulary

Procedure for Teaching: Each student will design their own stain glass window on an 8.5 X 11 sheet of white paper. Then the students will color their shapes. The students will then describe each shape, figure the dimensions and area of each shape, and give the entire area of the window.

Materials and Resources:

8.5 X 11 white paper, rulers and colored pencils

Scatter Plot Party

Grade Level: 8th

Focus: Data Analysis, Probability and Statistics

Concept: Scatter plots

Objectives

Students will be able to do the following:

- Measure
- Collect and record and organize data
- Display data in scatter plot
- Determine strength of relationship (i.e., # of bubbles related to length of your stride)
- Support your answer

Idaho Achievement Standards:

342.02 - Collect, organize and display data.

Content Knowledge and Skills: 342.02a - Collect, organize, and display data with appropriate notation in tables, charts, and graphs (scatter plots, line graphs, bar graphs, pie charts).

Procedure for Teaching: Set up stations where students can gather information. Students record information in a table (on the overhead or chalkboard). Students select two categories to plot (one for x-value, one for y-value). Students plot x and y-values (i.e., graph on overhead grids) and determine whether there is a strong, weak, or no relationship. Present rationale to class.

Materials and Resources:

Meter sticks, cloth tape measure, stop watch, chart with category and student names, individual station supplies.

Ideas for stations: Time to walk down the hall and back, length of stride, height, shoe size, arm span, distance between eyes, circumference of your head, span of palm, vertical jump, How long you can hold your breath, numerical number of your birthday, number of bubbles you can blow in 30 seconds, number of pets you have, number of siblings.

Where's Waldo – in the Coordinate Plane?

Grade Level: 8th

Focus: Measurement & Geometry

Concept: identify location in the coordinate plane

Objectives

Students will be able to do the following:

- Identify the four different quadrants in the coordinate plane.
- Identify the x- and y-coordinates in the coordinate plane.
- Locate and correctly name a point in the coordinate plane with an ordered pair.

Idaho Achievement Standards:

341.03 - Apply graphing in two dimensions.

Content Knowledge and Skills:

341.03a - Use the coordinate plane as it relates to real-world applications.

Procedure for Teaching: 1) Briefly review x- and y-coordinates and their location on the coordinate plane. 2) Sharing a book, each pair of students will locate Waldo on each page. 3) Using the coordinate plane over-lay, students will write on their own paper Waldo's location as an ordered pair. 4) Upon completion, the groups could share their ordered pair locations with the class. 5) A discussion as to why each group may not have exactly the same ordered pairs may be needed.

Materials and Resources:

Where's Waldo books (I pair the students together, so I use 15 books)

Coordinate planes drawn on laminating film

Tessellation T-Shirts

Grade Level: 8th

Focus: Measurement & Geometry

Concept: Create a tessellation to put on a t-shirt

Objectives

Students will be able to do the following:

- Create individual tessellations
- Explore the effects of reflections, translations, and rotations on their tessellations.

Idaho Achievement Standards:

341.01 - Apply concepts of size, shape, and spatial relationships.

Content Knowledge and Skills:

341.01g - Explore and model the effects of reflections, translations, and rotations on various shapes.

Procedure for Teaching

1) Have students design an original tessellation and draw it on the bond paper with the fabric crayons. The students will need to press hard onto the bond paper with the crayons. 2) On the ironing board, put the shirt first, then the design FACE DOWN, and then a regular piece of white paper over that. 3) Press hard when ironing - do not rub. Press hard, lift iron, press hard in another area.

Suggestions:

1) Make a sample t-shirt for the class to see, especially because the colors change somewhat when they are ironed. 2) Bond paper can be purchased from an office supply store. DO NOT use school copy paper. 3) Fabric crayons can be purchased from a fabric store or a discount store. Regular crayons do not work. 4) Shirts can be purchased from www.blankshirts.com.

Materials and Resources:

t-shirts - MUST be 50% cotton/50% polyester fiber content

fabric crayons

cotton fiber bond paper (25% thin bond suggested)

ironing board and iron (at least 2 - more, if possible)

Cereal Cardboard Boxes

Grade Level: 8th

Focus: Geometry and Measurement

Concept: Surface area and volume

Objectives

Students will be able to do the following:

- Find the surface areas and volumes of two rectangular prisms.
- Compare the volume to surface area ratios of the two prisms.

Idaho Achievement Standards:

339.01 Apply concepts of size, shape, and spatial relationship

341.01 Understand and use U.S. Customary and metric measurements

Content Knowledge and Skills:

339.01c Recognize the differences and relationships among measures of perimeter, area, and volume (capacity) in both systems

339.01d Solve problems involving length, perimeter, area, volume (capacity), weight, mass, and temperature.

341.01f Understand the concept of surface area and volume (capacity).

Procedure for Teaching: Have students work in groups of four. Each group is given two rulers and two cereal boxes (an individual serving size, and a large) of which to measure the length, width, and height. The students then compute the surface areas and volumes of the boxes. The groups then find the large to small ratios of the volumes and of the surface areas of the boxes. Compare the ratios to determine which box uses less material for the volume of cereal. As a class determine the relationship between the dimensions, the surface area, and the volume—what would happen to the surface area and the volume of the small box if the dimensions were each doubled. Discuss the environmental ramifications of purchasing the individual boxes as opposed to the large boxes.

Materials and Resources: Rulers, individual serving-size and large cereal boxes, rectangular prism nets. If available, a video on garbage.

What's the Probability?

Grade Level: 8th

Focus: Probability and Statistics

Concept: Determine the probability of having three girls in a family of three children by using simulation.

Objectives

Students will be able to do the following:

- The students will be able to find the probability using simulation and compare that to the theoretical probability.

Idaho Achievement Standards: 342.04, 342.04, 342.04, 342.05: Understand basic concepts of probability and make predictions based on data.

Content Knowledge and Skills: 342.04a, 342.04b, 342.04c, 342.05a:

Procedure for Teaching:

1. Choose either heads or tails to represent the birth of a girl.
2. Toss three coins and record the results.
3. Repeat the coin toss 30-50 times.
4. Identify your experimental probabilities that a family of three will have 0, 1, 2, and 3 females.
5. Identify other experimental probabilities such as $P(0 \text{ or } 1)$ and $P(\text{not } 0)$
6. Use a tree diagram to identify theoretical probabilities
7. Compare your experimental probabilities to the theoretical probabilities

Materials and Resources:

Paper, pen/pencil, graphing calculator with statistical capabilities, computer software with statistical capabilities or random digit table.

APPENDIX C

Idaho Student Information Technology Standards

8th Grade Idaho Student Information Technology Benchmarks

DRAFT – 12/17/2003

STANDARD 1:

Basic Operations and Concepts

Standard The student will:	Content Knowledge and Skills:
1. Demonstrate a sound understanding of the basic nature and operation of technology systems.	a. Use developmentally appropriate and accurate technology terminology.
	b. Identify the appropriate technology device to complete a task.
	c. Make informed choices among technology systems, resources and services.
2. Demonstrate proficiency in the use of technology.	a. Demonstrate increasingly sophisticated operation of technology components.
	b. Apply strategies for identifying and solving routine software and hardware problems that occur in everyday use.

STANDARD 2:

Social, Ethical, and Human Issues

Standard The student will:	Content Knowledge and Skills:
1. Demonstrate an understanding of the ethical, cultural, and societal issues related to technology.	a. Demonstrate knowledge of current changes in technologies and the effect those changes have on the workplace and society.
	b. Demonstrate knowledge of legal and ethical issues when using technology, information sources, and consequences of misuse.
2. Practice responsible use of technology systems, information, and software.	a. Practice responsible use of technological devices and software.
	b. Demonstrate respect for others while using technology.
	c. Exhibit legal and ethical behaviors when using technology and information.

STANDARD 3:
Technology Productivity Tools

Standard The student will:	Content Knowledge and Skills:
1. Use technology tools to enhance learning, increase productivity, and promote creativity.	a. Use formatting capabilities of technology for communicating and illustrating.
	b. Use a variety of technology tools for data collection and analysis.
	c. Publish and present information using technology tools.
	d. Use technology tools to support analysis and modeling.

STANDARD 4:
Technology Communications Tools

Standard The student will:	Content Knowledge and Skills:
1. Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.	a. Use telecommunications efficiently and effectively to access remote information and communicate with others in support of facilitated and independent learning.
	b. Use technology tools for individual and collaborative writing, communication and publishing activities to create curricular related products for audiences inside and outside the classroom.
	c. Collaboratively use telecommunications and online resources.

STANDARD 5:
Technology Research Tools

Standard The student will:	Content Knowledge and Skills:
1. Use technology to locate, evaluate, and collect information from a variety of sources.	a. Locate information from electronic resources.
	b. Evaluate the accuracy, relevance, appropriateness, comprehensiveness and bias of electronic information sources.
2. Use technology tools to process data and report results.	a. Select appropriate technology tools for data analysis and reporting.

STANDARD 6:
Technology Problem-Solving and Decision Making Tools

Problem solving is inherent in all disciplines. Technology Standard 6 is designed to provide a cumulative (capstone) experience.

Standard The student will:	Content Knowledge and Skills:
1. Use technology resources for solving problems and making informed decisions.	a. Determine when technology is useful, select and use the appropriate tools, and technology resources to solve the problem, and report findings.

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